

# Effect of SSPs and RCPs on the forest resources use

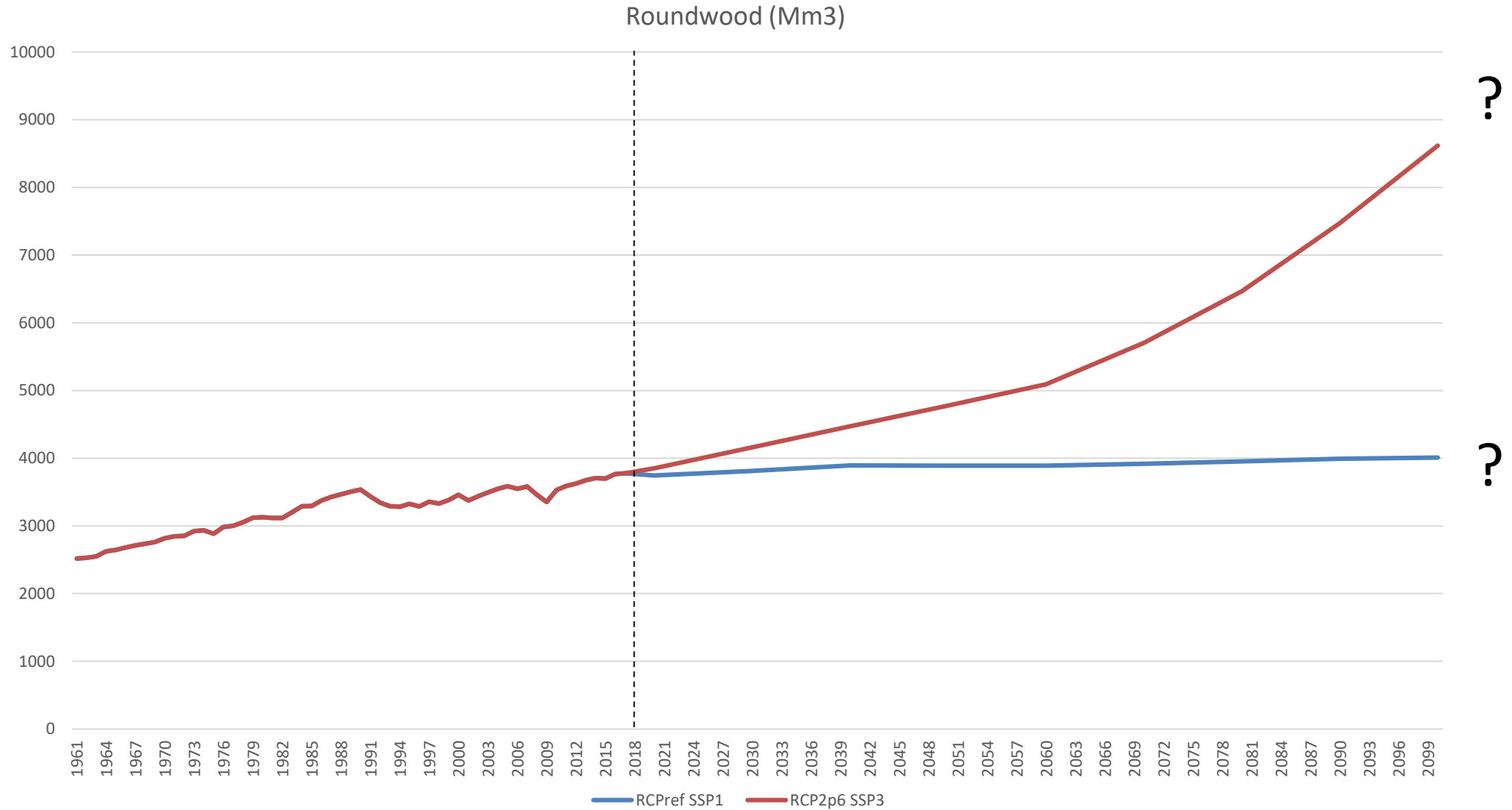
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- Purpose: Consider effects of Shared Socioeconomic Pathways (SSPs) and Representative Concentration Pathways (RCPs) on forest resources use.
- Method: Solve GLOBIOM model for different SSP-RCP scenarios and compare roundwood harvest volumes. Interpret harvest volumes as approximation of forest resources use and the effect on natural forests ecosystems.
- Results:
  - 1) SSPs affect roundwood harvest volumes almost as much as RCPs.
  - 2) Effect of RCPs can be controlled by carbon tax on forest management while it is more difficult to control effect of SSPs.

# Global roundwood harvest volumes 1960-2100



13.2.2019

# Why harvest volumes increase in the future ?

## 1) Socioeconomic development (SSPs)

-POP and GDP growth

POP  $\uparrow$   $\Rightarrow$  industrial roundwood and fuelwood demand  $\uparrow$   $\Rightarrow$  roundwood harvest volumes  $\uparrow$

GDP  $\uparrow$   $\Rightarrow$  industrial roundwood demand  $\uparrow$  (positive income-elasticity)

fuelwood demand  $\downarrow$  (negative income-elasticity)

$\Rightarrow$  roundwood harvest volumes  $\uparrow$   $\downarrow$

-other effects of SSPs ignored (no quantitative data available)

## 2) Climate mitigation (RCPs)

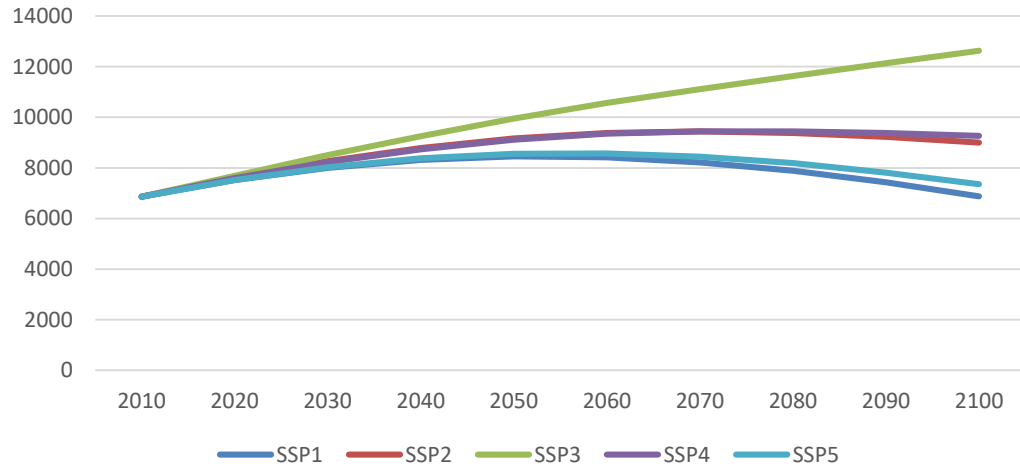
-bioenergy demand and carbon prices

bioenergy demand  $\uparrow$   $\Rightarrow$  roundwood use for energy  $\uparrow$   $\Rightarrow$  roundwood harvest volumes  $\uparrow$

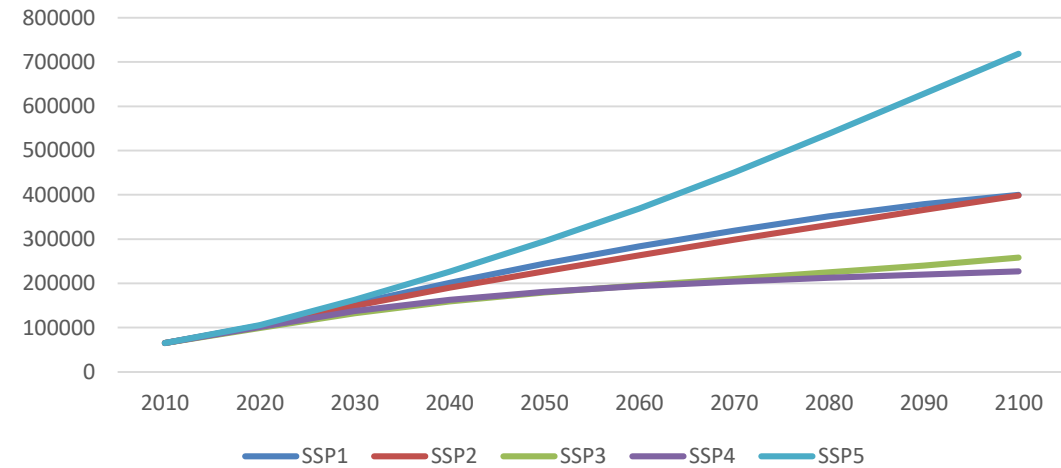
carbon price  $\uparrow$   $\Rightarrow$  roundwood harvest volumes  $\downarrow$  (if carbon tax on forest management)

# Effect of SSPs (for RECref): POP + GDP growth

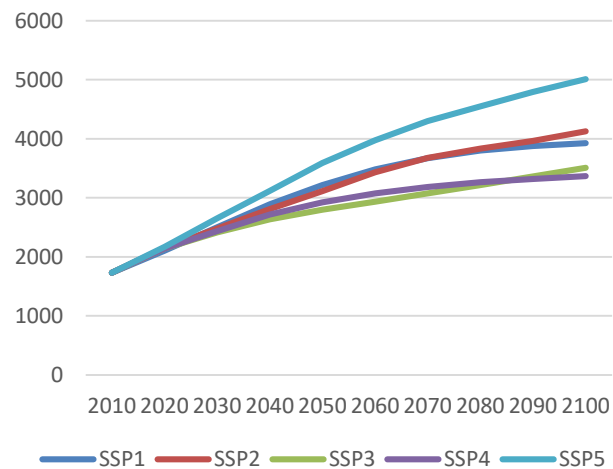
World population (Million)



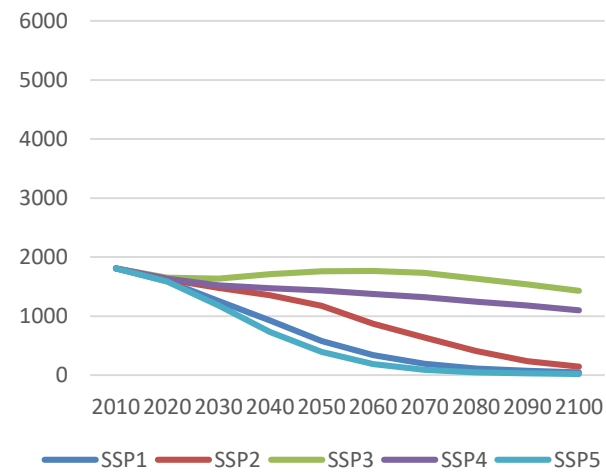
World GDP (Million \$ 2005)



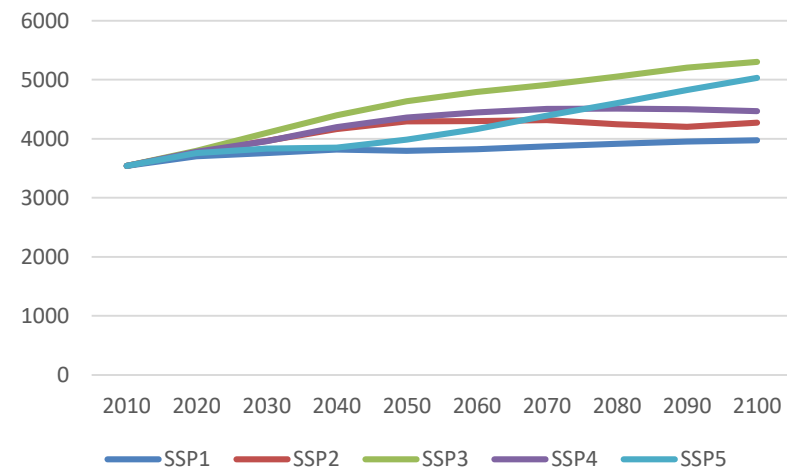
Industrial roundwood (Mm3)



Fuelwood (Mm3)

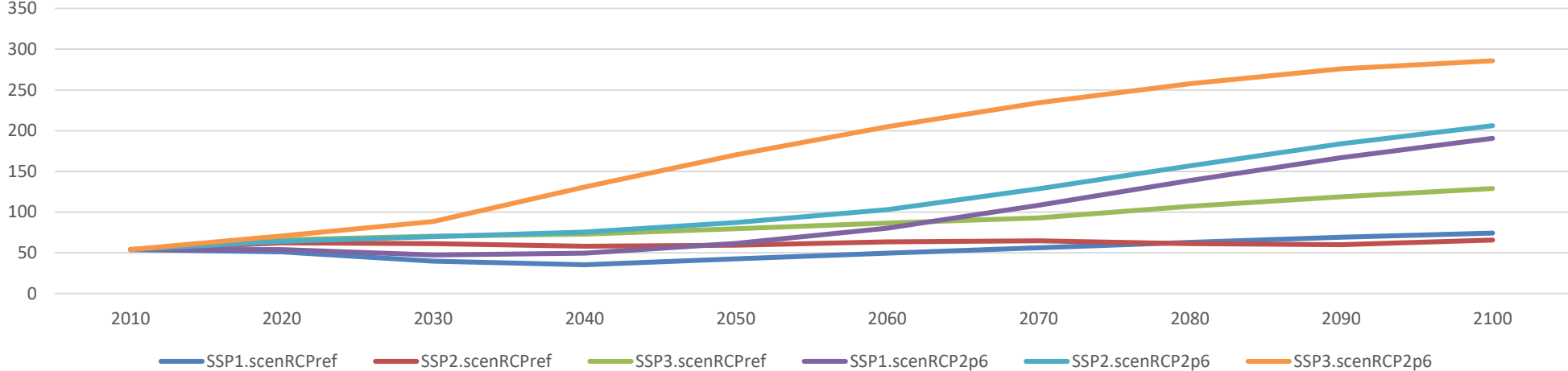


Roundwood (Mm3)

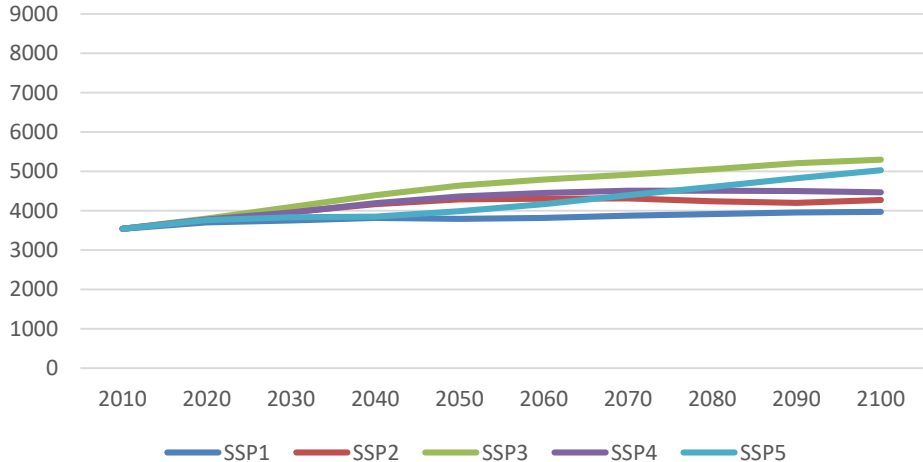


# Effect of RCPs: bioenergy demand

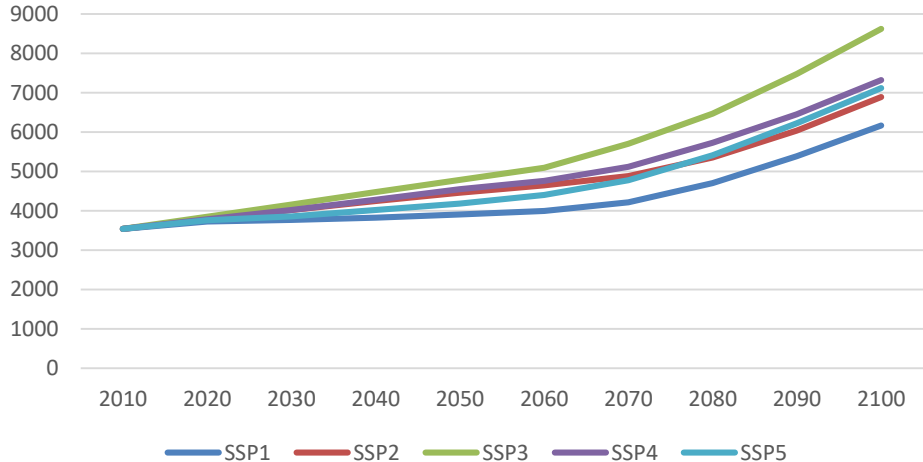
Bioenergy demand (EJ)



Roundwood (Mm3) RCPref



Roundwood (Mm3) RCP2p6



# Carbon tax on forest management

-tax on permanent decrease of carbon stock due to forest management

$$\text{tax} = \text{carbon price} \times \text{carbon stock change}$$

-carbon stocks changes based on G4M estimates of above and below ground living biomass

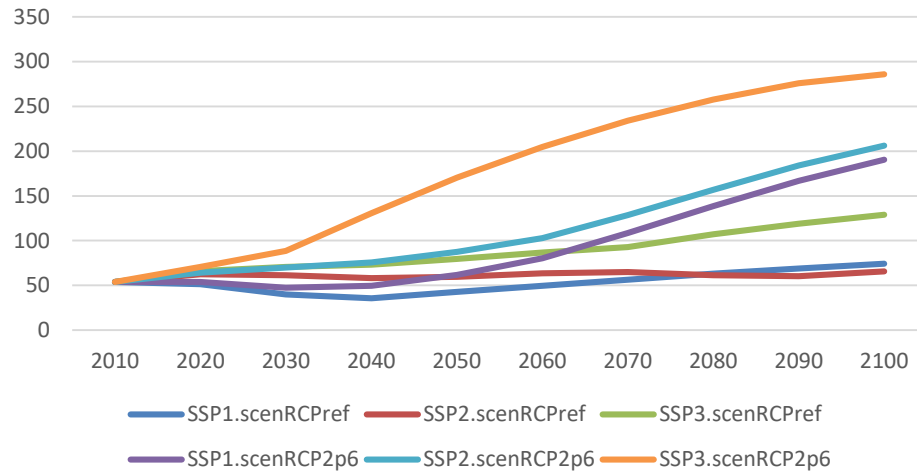
-carbon tax decreases roundwood use for energy but not much roundwood material use

=> Roundwood use for energy more elastic than roundwood use for material products

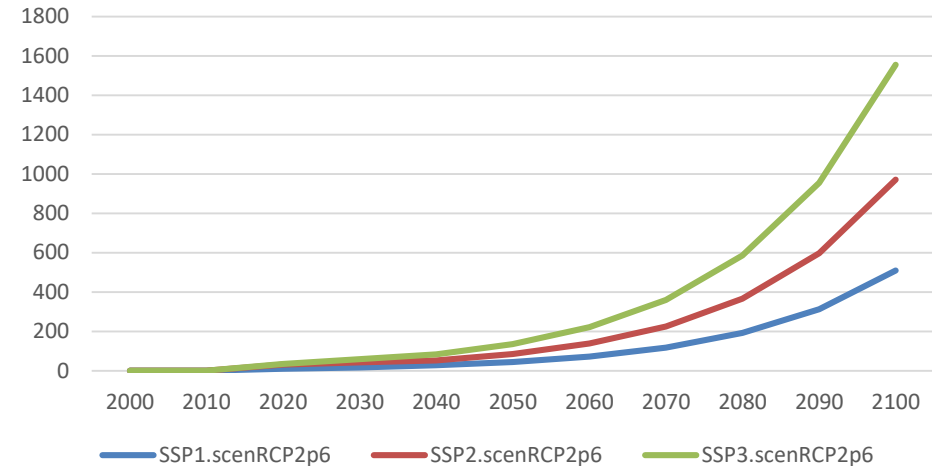
=> In energy use roundwood can be substituted easily by other feedstocks (residues, energy crops) while in material use it is more difficult.

# Effect of RCPs with carbon tax on forest management

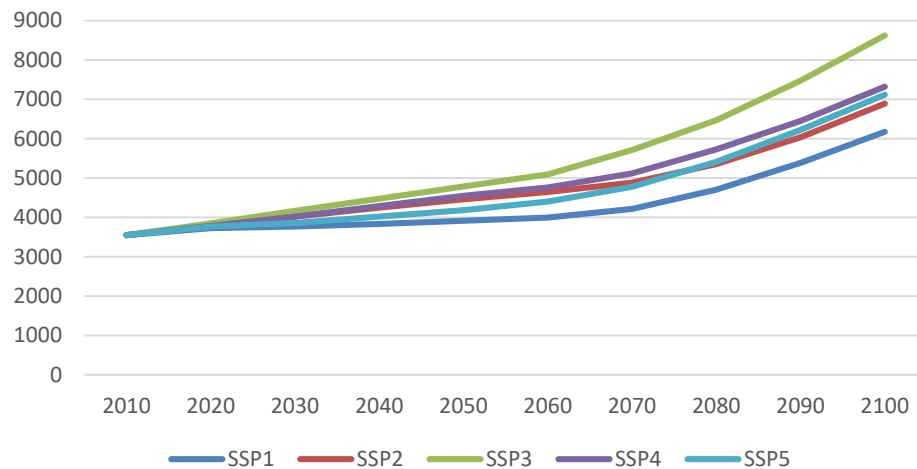
Bioenergy demand (EJ)



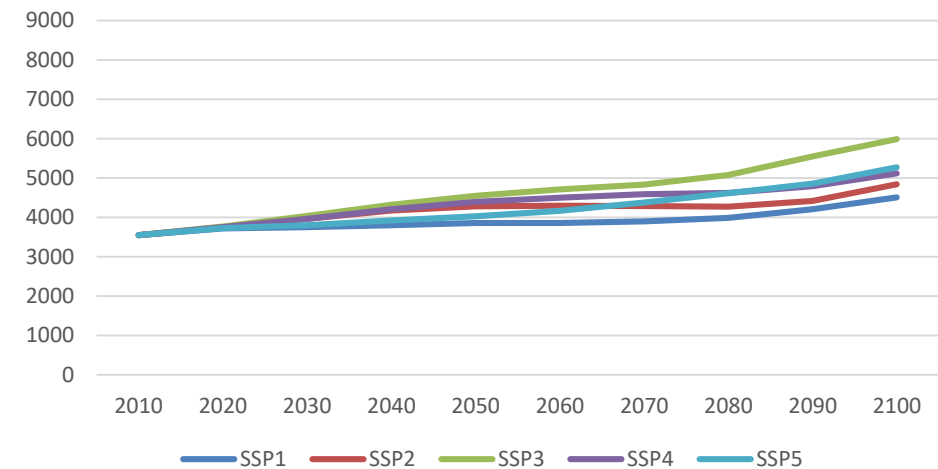
Carbon prices (\$/tCO2)



Roundwood (Mm3) RCP2p6 without tax



Roundwood (Mm3) RCP2p6 with Ctax



# Conclusions

- 1) Socioeconomic development affects global forest resources use almost as much as climate mitigation
  - variation between RCPs +0-60% relative to RCPref
  - variation between SSPs +0-40% relative to SSP1
- 2) The effect of climate mitigation can be decreased significantly by carbon tax on forest management
  - variation between RCPs with tax +0-10% relative to RCPref
  - variation between SSPs with tax +0-35% relative to SSP1
- 3) Socioeconomic development (SSPs) might cause a larger threat for natural forests ecosystems than climate mitigation (RCPs), because it is more difficult to control forest resources material use by carbon tax policy.



# GLOBIOM model

<http://www.globiom.org/>

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## GLOBIOM

**A global model to assess competition for land use between agriculture, bioenergy, and forestry**

IIASA's Global Biosphere Management Model (GLOBIOM) is used to analyze the competition for land use between agriculture, forestry, and bioenergy, which are the main land-based production sectors. As such, the model can provide scientists and policymakers with the means to assess, on a global basis, the rational production of food, forest fiber, and bioenergy, all of which contribute to human welfare.

### About

**GLOBIOM**

The GLOBIOM model has global coverage, with 30 regions currently represented in the global version.

Regional versions of the model, such as GLOBIOM-BRAZIL and GLOBIOM-EU, have been designed with national and regional institutes. These versions provide more detailed spatial representation of land use changes to assess the impact of specific regional policies.

The GLOBIOM approach is strongly grounded in the idea that the production of food, forest fiber, and bioenergy, must be analyzed and planned in an integrated way across agriculture and forestry, forestry, and bioenergy sectors. GLOBIOM can be

### FAST FACTS

- The 18 globally most important crops covered in GLOBIOM are barley, dry beans, cassava, chick peas, corn, cotton, groundnut, millet, potatoes, rapeseed, rice, soybeans, sorghum, sugarcane, sunflower, sweet potatoes, wheat, and oil palm. The GLOBIOM-EU version extends this to 27 crops.

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### PUBLICATIONS

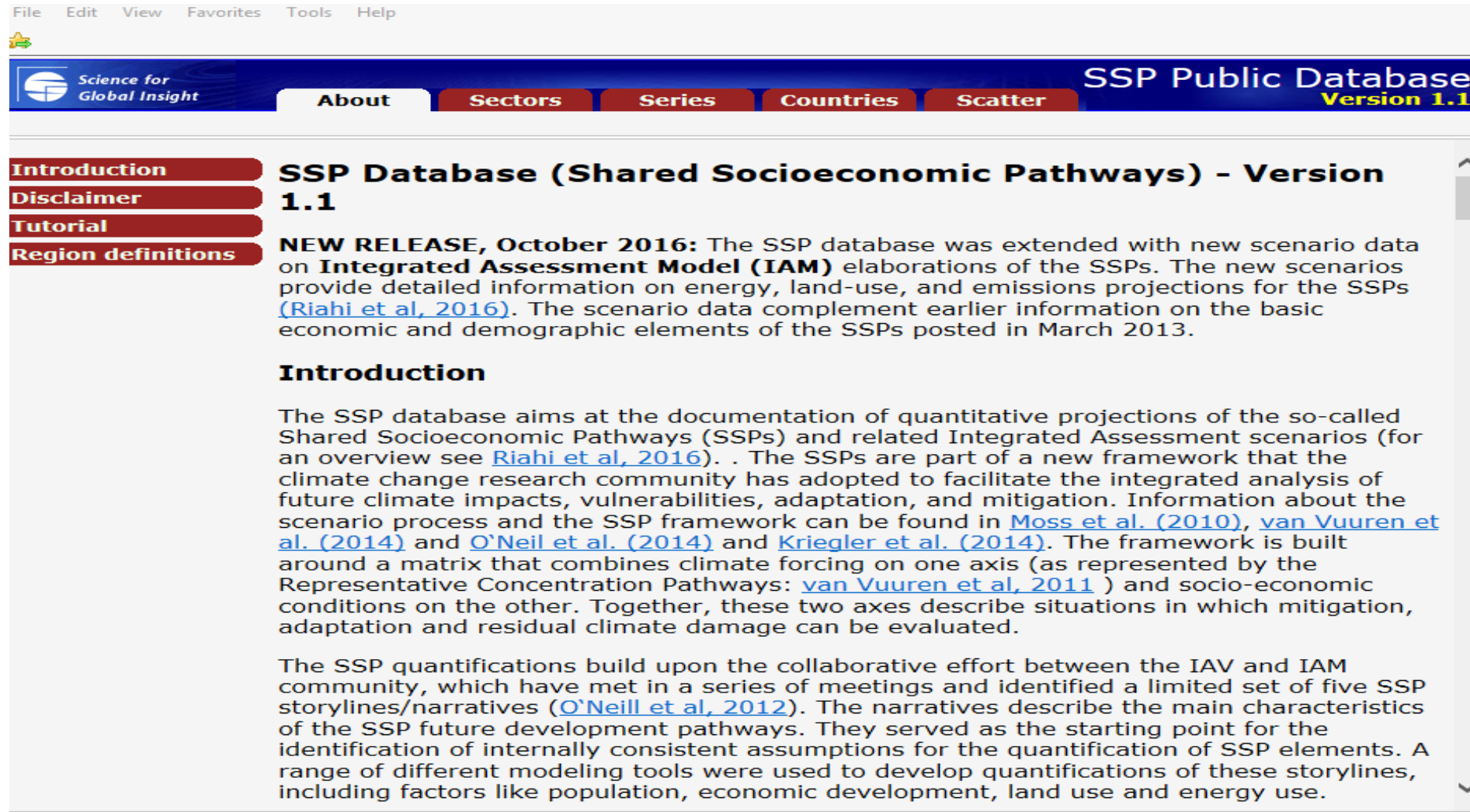
- » **Havlik P, Valin H**, Herrero M... (2014)  
Climate change mitigation through livestock system transitions
- » **Mosnier A, Obersteiner M**,

**Research Overview**

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# SSP-RCP scenario data

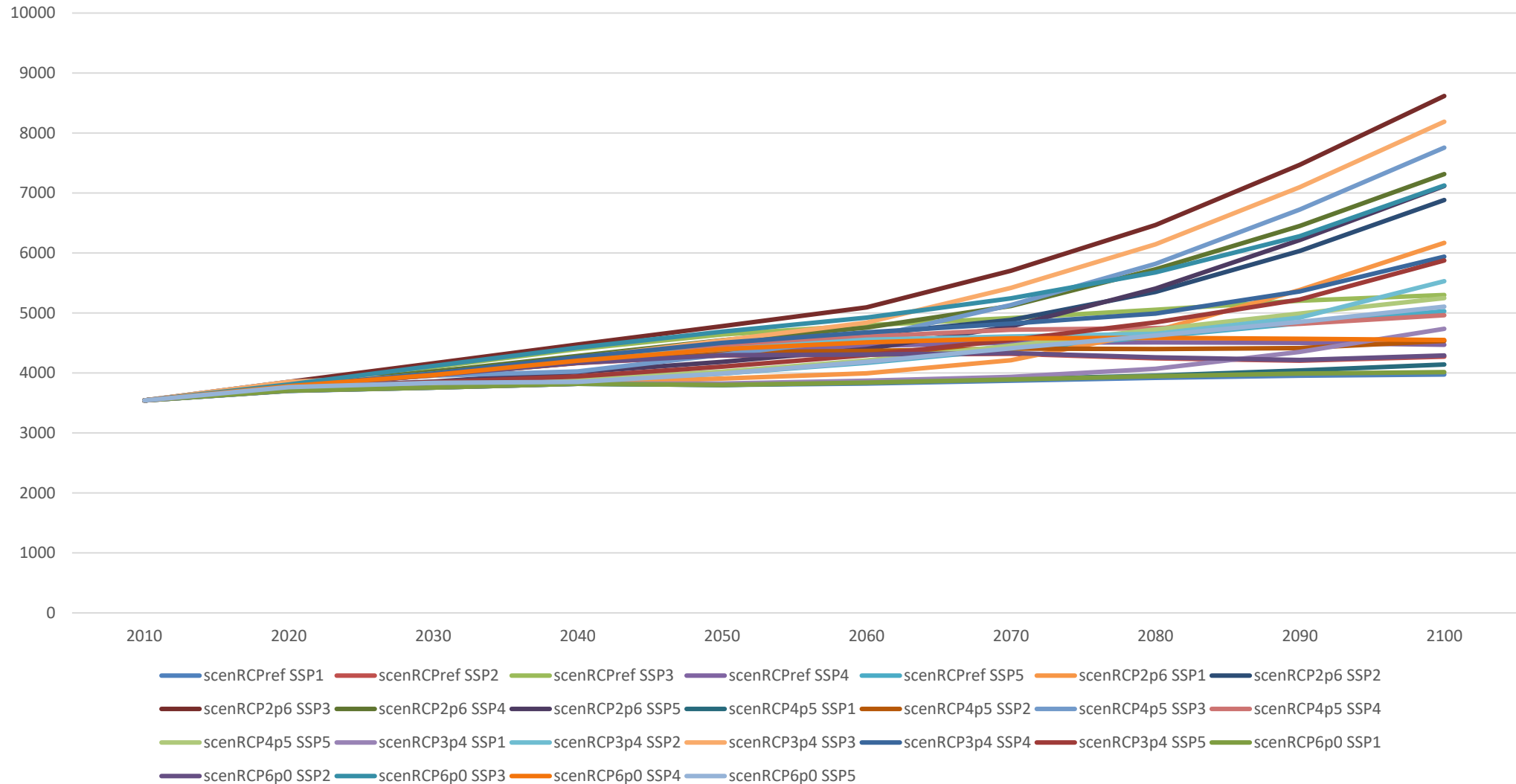
SSP database: <https://tntcat.iiasa.ac.at/SspDb/>



The screenshot shows the web browser interface for the SSP Public Database. At the top, there is a menu bar with 'File', 'Edit', 'View', 'Favorites', 'Tools', and 'Help'. Below the menu bar is a navigation bar with the logo 'Science for Global Insight' on the left and 'SSP Public Database Version 1.1' on the right. The navigation bar contains several tabs: 'About', 'Sectors', 'Series', 'Countries', and 'Scatter'. The 'About' tab is currently selected. On the left side of the page, there is a vertical menu with links: 'Introduction', 'Disclaimer', 'Tutorial', and 'Region definitions'. The main content area displays the title 'SSP Database (Shared Socioeconomic Pathways) - Version 1.1' and a 'NEW RELEASE, October 2016:' announcement. The announcement text states: 'The SSP database was extended with new scenario data on Integrated Assessment Model (IAM) elaborations of the SSPs. The new scenarios provide detailed information on energy, land-use, and emissions projections for the SSPs (Riahi et al, 2016). The scenario data complement earlier information on the basic economic and demographic elements of the SSPs posted in March 2013.' Below the announcement is an 'Introduction' section. The introduction text reads: 'The SSP database aims at the documentation of quantitative projections of the so-called Shared Socioeconomic Pathways (SSPs) and related Integrated Assessment scenarios (for an overview see Riahi et al, 2016). . The SSPs are part of a new framework that the climate change research community has adopted to facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptation, and mitigation. Information about the scenario process and the SSP framework can be found in Moss et al. (2010), van Vuuren et al. (2014) and O'Neil et al. (2014) and Kriegler et al. (2014). The framework is built around a matrix that combines climate forcing on one axis (as represented by the Representative Concentration Pathways: van Vuuren et al, 2011 ) and socio-economic conditions on the other. Together, these two axes describe situations in which mitigation, adaptation and residual climate damage can be evaluated.' The final paragraph of the introduction states: 'The SSP quantifications build upon the collaborative effort between the IAV and IAM community, which have met in a series of meetings and identified a limited set of five SSP storylines/narratives (O'Neill et al, 2012). The narratives describe the main characteristics of the SSP future development pathways. They served as the starting point for the identification of internally consistent assumptions for the quantification of SSP elements. A range of different modeling tools were used to develop quantifications of these storylines, including factors like population, economic development, land use and energy use.'

# All SSP-RCP scenarios

Roundwood (Mm3)





# Lauri et al. (2017): RCP2p6 increases global forest resources use 60% comparing to RCPref in SSP2

Forest Policy and Economics 83 (2017) 121–130



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Forest Policy and Economics

journal homepage: [www.elsevier.com/locate/forpol](http://www.elsevier.com/locate/forpol)



## Impact of the 2 °C target on global woody biomass use



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### A B S T R A C T

In this study we investigate the implications of reaching the 2 °C climate target for global woody biomass use by applying the Global Biosphere Management Model (GLOBIOM) and the recently published SSP-RCP scenario calculations. We show that the higher biomass demand for energy needed to reach the 2 °C target can be achieved without significant distortions to woody biomass material use and that it can even benefit certain forest industries and regions. This is because the higher woody biomass use for energy increases the demand for forest industry by-products, which makes forest industry final products production more profitable and compensates for the cost effect of increased competition over raw materials. The higher woody biomass use for energy is found to benefit sawnwood, plywood and chemical pulp production, which provide large amounts of by-products, and to inhibit fiberboard and mechanical pulp production, which provide small amounts of by-products. At the regional level, the higher woody biomass use for energy is found to benefit material production in regions, which use little roundwood for energy (Russia, North-America and EU28), and to inhibit material production in regions, which use large amounts of roundwood for energy (Asia, Africa and South-America). Even if the 2 °C target increases harvest volumes in the tropical regions significantly compared to the non-mitigation scenario, harvest volumes remain in these regions at a relatively low level compared to the harvest potential.